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Air Pollution - Third Follow-Up Report Air Pollution Pilot Study

NATO Committee on the Challenges of Modern Society, Brussels (Belgium)

Sep 77

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COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY

NATO CCMS

OTAN CCMS

AIR POLLUTION

THIRD FOLLOW-UP REPORT-AIR POLLUTION PILOT STUDY

N. 67

POLLUTION ATMOSPHERIQUE

TROISIÈME RAPPORT SUR LES SUITES À DONNER DE L'ETUDE PILOTE SUR LA POLLUTION ATMOSPHERIQUE

COMITÉ SUR LES DÉFIS DE LA SOCIÉTÉ MODERNE

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16. ABSTRACT

The 3d follow-up report on the 15 Air Pollution Pilot Study recommendations is to concentrate on the status of North Atlantic Council, NATO/Committee on the Challenges of Modern Society Recommendations 1 through 8 in cities with populations over 600,000 in 1977. It also can be compared to responses to the 1975 and 1976 surveys and follow-up reports to evaluate changes in air pollution activities in the past 2 years. The Recommendations include general assessment of air pollution, standard-setting, establishment of air quality monitoring systems and suitable systems and suitable systems for retrieval and storage of data, employment of recognized reference methods for monitoring and institution of uniform procedures for conducting emissions inventories.

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AIR POLLUTION

THIRD FOLLOW-UP REPORT -

AIR POLLUTION PILOT STUDY

(POLLUTION ATMOSPHERIQUE

TROISIEME RAPPORT SUPPLEMENTAIRE -
ETUDE PILOTE DE POLLUTION ATMOSPHERIQUE)

N. 67

Prepared by

United States of America
as ex-Pilot of the Study

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on the
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EXECUTIVE SUMMARY:

THIRD AIR POLLUTION PILOT STUDY FOLLOW-UP REPORT

The third follow-up report on the 15 Air Pollution Pilot Study recommendations is to concentrate on the status of NAC NATO/CCMS Recommendations I, II, III, IV, V, VII, VIII and XIV in cities with populations over 600,000 in 1977. It also can be compared to responses to the 1975 and 1976 surveys and follow-up reports to evaluate changes in air pollution activities in the past two years. The Recommendations include general assessment of air pollution, standard-setting, establishment of air quality monitoring systems and suitable systems for retrieval and storage of data, employment of recognized reference methods for monitoring and institution of uniform procedures for conducting emissions inventories.

Responsiveness

The survey included 51 cities with populations over 600,000 and the capitals of the three nations with no cities over 600,000. At the time of printing of this summary, responses had been received for 37 of the 54 cities. Of the eight responding nations, five nations submitted completed questionnaires for all surveyed cities. Seven nations have yet to respond.

STANDARDS AND CONTROL APPROACHES

A basic difference in the approaches and objectives of national air pollution programs involves ambient standards. Some nations place

primary emphasis on the quality of ambient air, while others concentrate on standards set for specific categories of emission sources. A total of five nations reported ambient standards. This includes newly-reported standards in one nation, for average pollutant levels during the six winter months.

AMBIENT MONITORING

Objectives

The objectives of current monitoring systems were ranked to provide a reference point for evaluation of the effectiveness of systems. Four of the five nations with ambient air quality standards reported assessment of compliance with standards as their first priority objective. Trend analysis and control strategy planning were generally ranked above health research and emergency episode operations. Validation of dispersion models has a uniformly low priority. One nation reported significant revision of priorities since the 1976 survey. Other nations have had only minor changes or no changes at all.

Instrumentation

All responding nations have monitoring sites. All but two of these nations reported having some automated sites. Only two nations lacked meteorological instruments. Only two cities reported no automatic instruments, and eight cities reported at least half of their instruments automated. Basic differences in monitoring techniques and strategies result in wide variations of the number of monitoring sites in cities. Only a few minor changes in monitoring instrumentation have been made since 1975.

Ambient Monitoring Statistics

The nations reporting ambient air quality standards also reported ambient monitoring statistics for almost every relevant pollutant. Two nations did not report current ambient monitoring statistics corresponding to one or more standards. All but one responding nation reported statistics for at least two pollutants.

ANALYSIS OF AMBIENT AIR QUALITY TRENDS

A total of 63 analyses of ambient air quality trends was reported, for five nations and 30 cities. Three reporting nations and seven reporting cities had no trend analysis. Ten cities reported a trend for only one pollutant. The trend analyses were predominantly for SO_2 and TSP. Some analyses of trends for CO, O_x, NO_x, F^-, lead and soiling index were reported. The average length of monitoring period for trend analysis was 6.1 years. Most of the analyses were based on data for the period of 1970-1975. A few were only for two or three years.

Thirty-three cases of improving air quality (constantly decreasing ambient concentration) and fifteen cases of stable air quality over the entire analysis period were reported. There were three reported cases of air quality declining over the entire analysis period, and a number of variable trends were also reported.

ATMOSPHERIC DISPERSION MODELING

Twenty-six cities in six nations reported some modeling activity. Fifty-eight instances of modeling were reported, all but five being for

TSP (14), SO_2 (21), or CO (17). Eleven responding cities had no models, and seven more had modeled only one pollutant. Most models (45) were Gaussian rather than numerical (7) or empirical (5). Three-quarters of the models had planning as one of their purposes, 13 were also used for regulatory purposes, and only 8 for research. A number of CO models were added to those previously reported in one nation and several previously-reported models were not mentioned in this year's responses.

INTRODUCTION

This is the third follow-up report on 15 of the Air Pollution Pilot Study Recommendations. Information for the report was collected through a questionnaire prepared by the United States, as pilot of the completed first air pollution pilot study. (See Appendix for Recommendations.)

The plan called for annual reporting to track progress of member nations with respect to eight of the 15 recommendations. Specifically, the first and second reports (issued September 19, 1975 and September 24, 1976) and this third report concentrate on the status of Recommendations I, II, III, IV, V, VII, VIII, and XIV in cities with populations over 600,000. These Recommendations include general assessment of air pollution standard-setting, establishment of air quality monitoring systems and suitable systems for retrieval and storage of data, employment of recognized reference methods for monitoring, and institution of uniform procedures for conducting emissions inventories. The results of this third year's follow-up questionnaire, analyzed in this report, are intended to provide information on current activities relevant to the Recommendations and to allow comparison with activities reported in response to the first and second follow-ups.

Responsiveness

Eight nations submitted responses for a total of thirty-seven cities. Five of these nations submitted completed questionnaires for all surveyed cities. Two nations submitted completed questionnaires

for all but one or two cities. One nation's response consisted of answers to one question. Responses have yet to be received from seven nations. Three of these nations did not submit questionnaires in last year's survey.

The survey included 51 cities with populations over 600,000 and the capitals of the three nations with no cities over 600,000. At the time of report finalization, responses had been received for 37 of these 54 cities, as listed in Figure 1. All but two of these cities also responded to both previous surveys. Seven cities have not responded to any of the three annual surveys.

When blank lines appear beside a city or a nation in figures with this report, they indicate that no response was received from that city or nation for that question. To assure currency of the information in this report, information reported for previous follow-up reports was not used.

Populations and Areas of Reporting Cities

Figure 2 presents the populations and areas of reporting cities. These statistics are useful in assessing the relative magnitude or significance of various information (e.g., air quality data, number of monitoring sites, refinement of control efforts). Differences in geographical approaches to air pollution control between nations result in considerable variety in the types of areas and populations for which responses were made. Some nations included only the highly urbanized areas within the political boundaries of a city. Others reported for

RESPONSES

BELGIUM
Brussels

CANADA
Montreal
Ottawa
Toronto
Vancouver

GERMANY
Cologne
Dortmund
Dusseldorf
Essen
Frankfurt
Hamburg
Munich

GREECE
Athens

ITALY
Genoa
Milan
Rome
Turin

LUXEMBOURG
Luxembourg City

NORWAY
Oslo

UNITED STATES
Baltimore
Boston
Chicago
Cleveland
Dallas
Detroit
District of Columbia
Houston
Indianapolis
Los Angeles
Memphis
Milwaukee
New York City
Philadelphia
St. Louis
San Antonio
San Diego
San Francisco

NO RESPONSE

DENMARK
Copenhagen

FRANCE
Marseille
Paris

GERMANY
Stuttgart

ICELAND
Reykjavik

ITALY
Naples
Palermo

NETHERLANDS
Amsterdam
Rotterdam

PORTUGAL
Lisbon

TURKEY
Ankara
Istanbul

UNITED KINGDOM
Birmingham
Glasgow
Liverpool
London
Manchester

FIGURE 1
Survey Responses

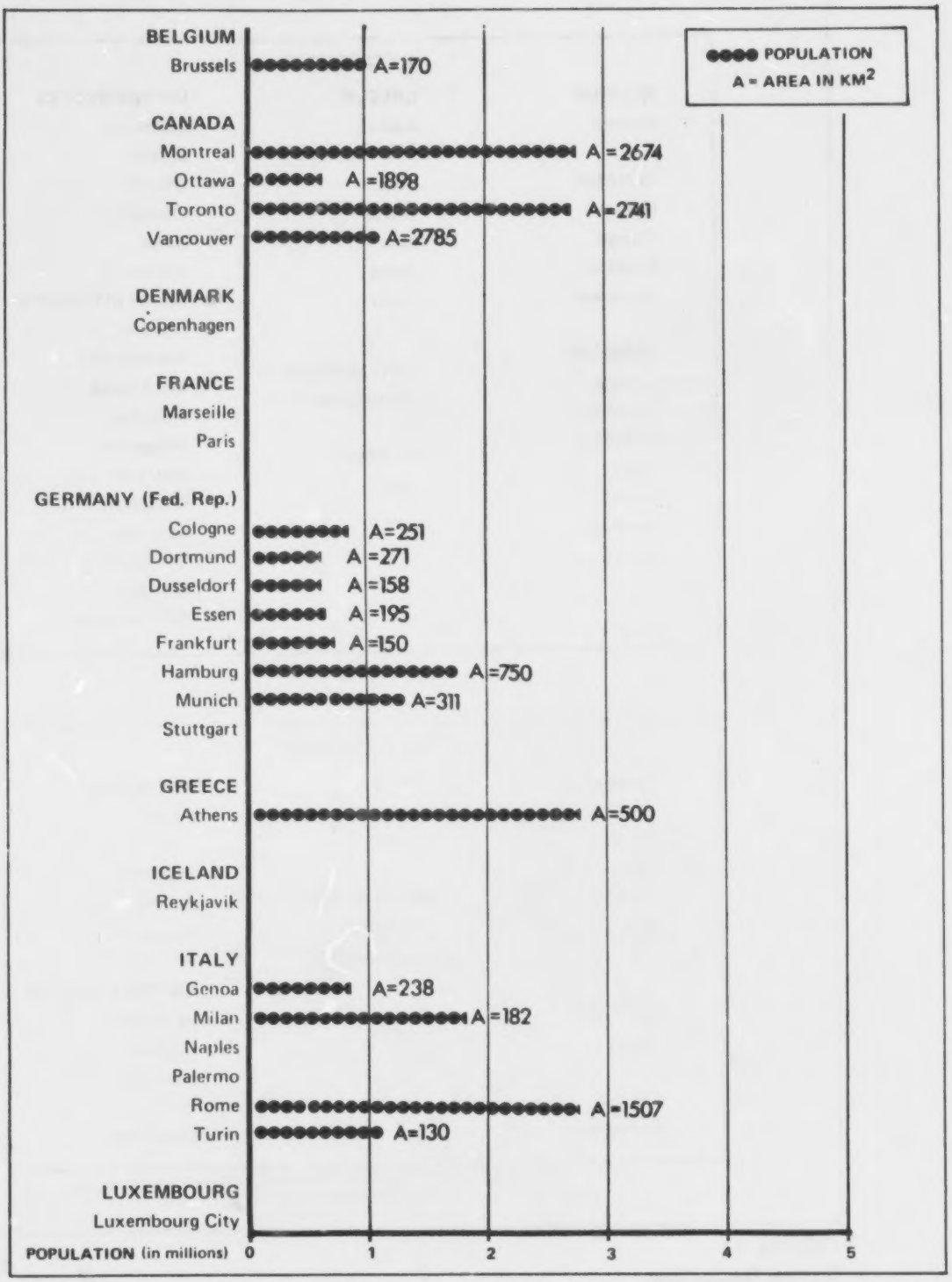


FIGURE 2
Reported Populations and Areas

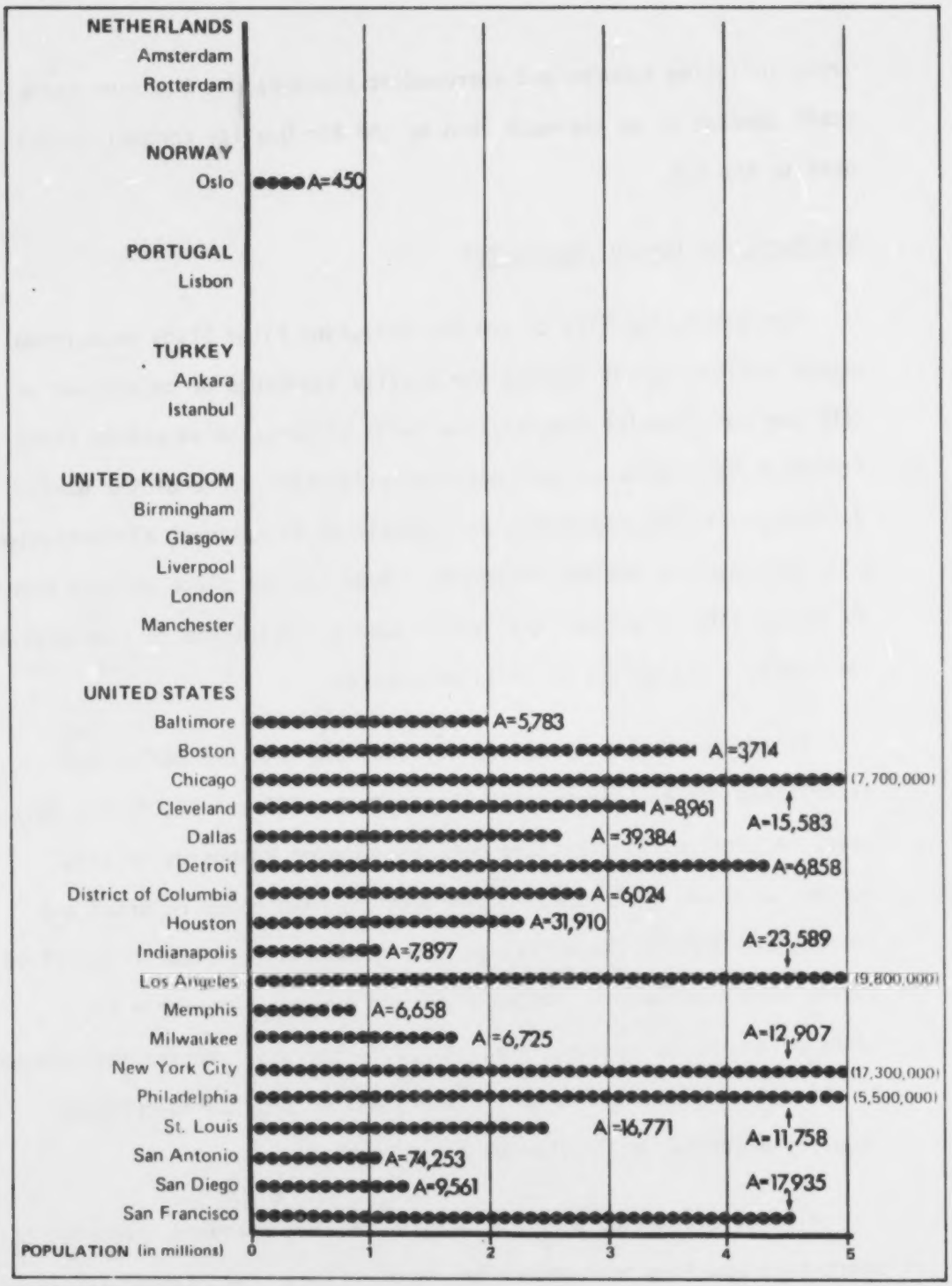


FIGURE 2 (continued)
Reported Populations and Areas

areas including suburbs and surrounding countryside, based on the air basin concept or an approach such as the Air Quality Control Region used in the U.S.

Standards and Control Approaches

Recommendation VIII of the Air Pollution Pilot Study encourages member nations to set ambient air quality standards or objectives using CCMS and World Health Organization (WHO) criteria to establish those standards in accordance with national priorities. One of the basic differences in the approaches and objectives of national air pollution programs involves ambient standards. Some nations place primary emphasis on the quality of ambient air, while others concentrate on standards set for specific categories of emission sources.

Responses to the current survey indicate that one nation has established ambient air quality standards for TSP and SO_x in the last year. A total of five nations reported ambient standards in this survey, as shown in Figure 3. Nine nations have never reported any ambient standards. The actual ambient standards reported in the first survey have not changed. Often standards are not comparable in terms of averaging or other statistical techniques. Monitoring schemes, by which the standards are applied, are either population-oriented, industry-oriented, or located on a grid system.

All but one nation with ambient TSP and SO_2 standards reported both short-term and long-term standards. Most nations have 24-hour and annual

	AMBIENT STANDARDS				NUMBER OF SOURCE STANDARDS
	TSP	SO_x	CO	O_x	
BELGIUM					2
CANADA	●	●	●	●	10
DENMARK					
FRANCE					
GERMANY (Fed. Rep.)	●	●	●		
GREECE					
ICELAND					
ITALY	●	●	●		
LUXEMBOURG					
NETHERLANDS					
NORWAY	●	●			3
PORTUGAL					
TURKEY					
UNITED KINGDOM					
UNITED STATES	●	●	●	●	13

FIGURE 3
Nations Reporting Standards

standards for TSP and SO_2. For SO_2, two short-term standards are one-half hour averages and one long-term standard is a daily average. One short-term TSP standard is for two hours. One nation employs an average over the six winter months for TSP and SO_2. Short-term CO standards are for one-half hour or one hour. Long-term standards reported include 8-hour daily and annual averages. Oxidant (O_x) standards are also mixed, including 1-hour, daily and annual averages.

Four nations reported emissions source standards in the current survey. One of these nations had not reported source standards before, and one nation has added standards for two source types. Seven nations have never reported any source standards. (Nations are checked in Figure 3 if they reported any type of ambient standard. When cities within single countries reported differing sets of local or regional standards, the total of unduplicated source categories for the whole country is presented.)

AMBIENT MONITORING

Objectives

Recommendation II of the Air Pollution Pilot Study encouraged establishment of an effective air quality monitoring system, including measurement of meteorological parameters. The objectives of current monitoring systems were ranked to provide a reference point for evaluation of the effectiveness of systems. These rankings by cities were aggregated to remove slight differences within nations, and are presented in Figure 4.

	ASSESS COMPLIANCE WITH STANDARDS	HEALTH RESEARCH	TREND ANALYSIS	CONTROL STRATEGY PLANNING	EMERGENCY EPISODE OPERATIONS	DISPERSION MODEL VALIDATION
BELGIUM		2	5	1	3	4
CANADA	1	4	3	2	5	6
DENMARK						
FRANCE						
GERMANY (Fed. Rep.)	1	5	4	3	2	6
GREECE		1	2	3	5	4
ICELAND						
ITALY	1	4	2	5	3	6
LUXEMBOURG						
NETHERLANDS						
NORWAY	4	3	1	2	6	5
PORTUGAL						
TURKEY						
UNITED KINGDOM						
UNITED STATES	1	6	2	3	4	5

FIGURE 4
Monitoring Objectives

All but one of the nations reporting ambient air quality standards reported the assessment of compliance with these standards as the first priority objective of their monitoring systems. Trend analysis and control strategy planning were generally ranked above health research and emergency episode operations, although these priorities were ranked differently in each country. Dispersion model validation received a uniformly low priority. Variations in rankings obtained for different cities in some nations indicate that these rankings do not necessarily represent official or legislated national objectives.

Most nations have reported little or no change in monitoring objectives. Two nations have reported no change since the first follow-up survey. One nation has reported significant revision of priorities since last year's survey. Others have had only minor changes.

Instrumentation

Figure 5 shows the number of ambient monitoring sites reported by each city and the degree of automation of these sites. Each responding city has some monitoring, and all but two cities have at least one automatic site. Eight cities reported at least half of their sites automated. Nine cities in two nations reported no meteorological instruments (see Figure 6). As observed in previous surveys, basic differences in monitoring techniques and strategies result in wide variations of the number of monitoring sites in cities. Only a few minor changes in monitoring instrumentation have been made since the first survey in 1975, with no clear trend.

Handling of Ambient Monitoring Data

Recommendation IV calls for systems for storage and retrieval of monitoring data such as those employed by the WHO. The efficiency of data handling techniques used by reporting cities can be tracked by questions dealing with telemetering of data and automation of data handling. The responses to these questions have been summarized in Figure 7. All but one of the reporting nations use automatic data handling systems to some degree. The degree of automation employed varies considerably, both from nation to nation and between cities in some nations. Two nations are almost completely computerized, and two more report automated or semi-automated handling of a majority of their data.

This year's responses were nearly identical to those received in 1975. Twenty-one cities, of the thirty-seven responding, reported at least half of their data handled by semi-automatic or automatic methods. Six cities rely on totally manual data-handling, and nine others use manual methods for at least half of their data.

Ambient Monitoring Statistics

The nations reporting ambient air quality standards (Figure 3) also reported ambient monitoring statistics for almost every relevant pollutant. Two nations did not report current ambient monitoring statistics corresponding to one or more ambient standards. All but one responding nation reported statistics for at least two pollutants. Figures 8 and 9

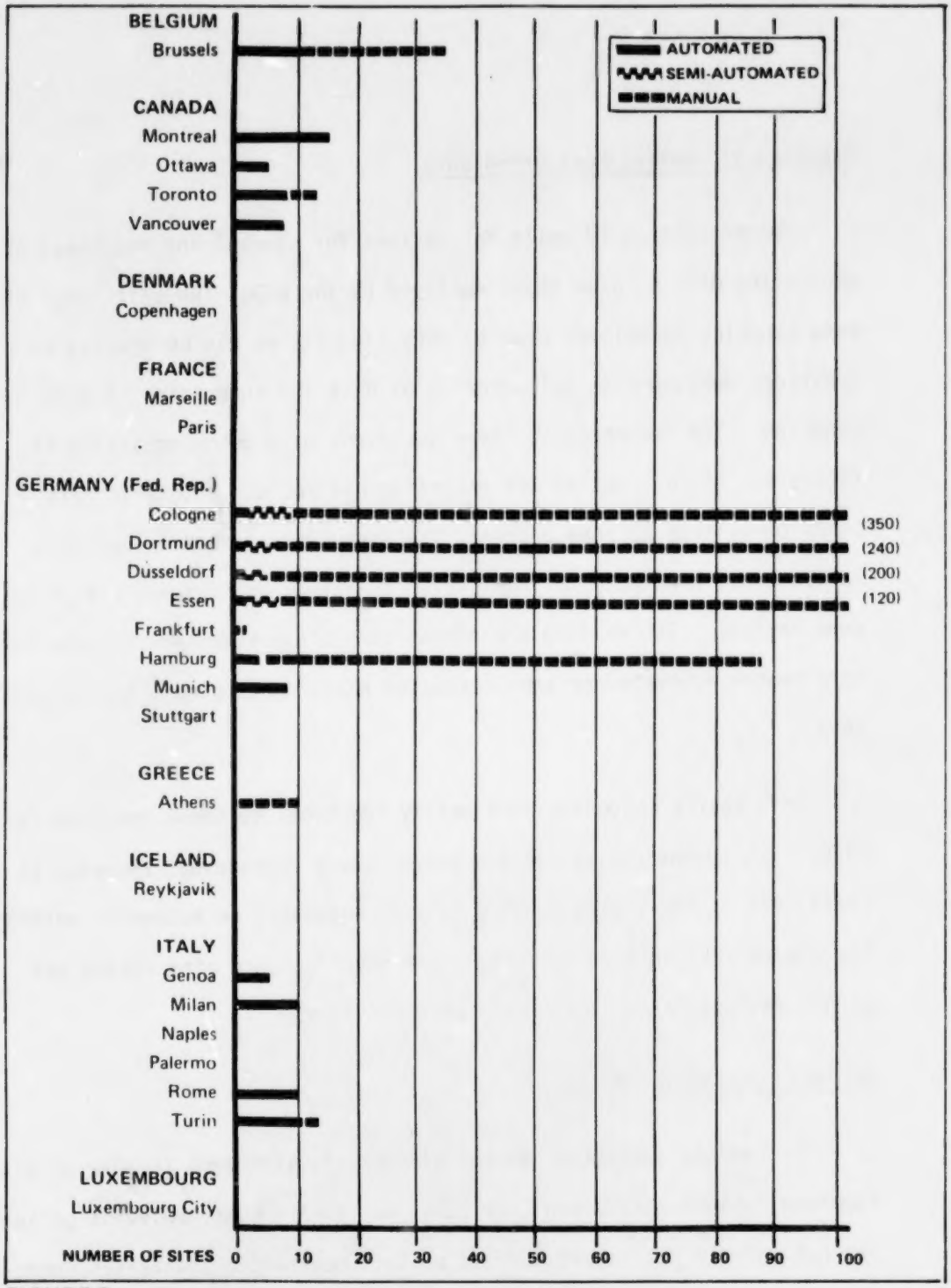


FIGURE 5
Sites with Automated and/or Manual Monitoring Instruments
(May contain double-counting of sites with multiple instrument types.)

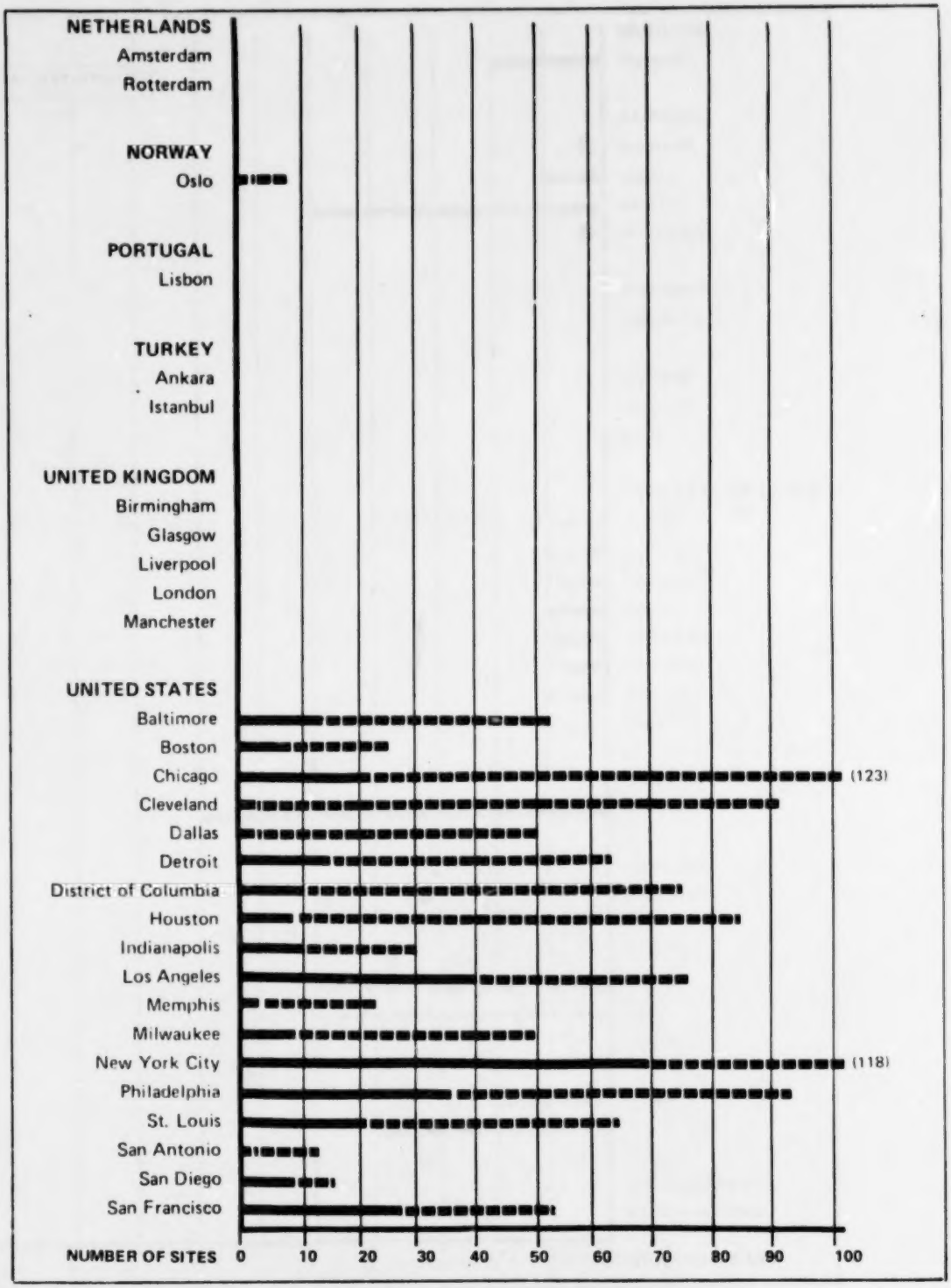


FIGURE 5 (continued)
Sites with Automated and/or Manual Monitoring Instruments

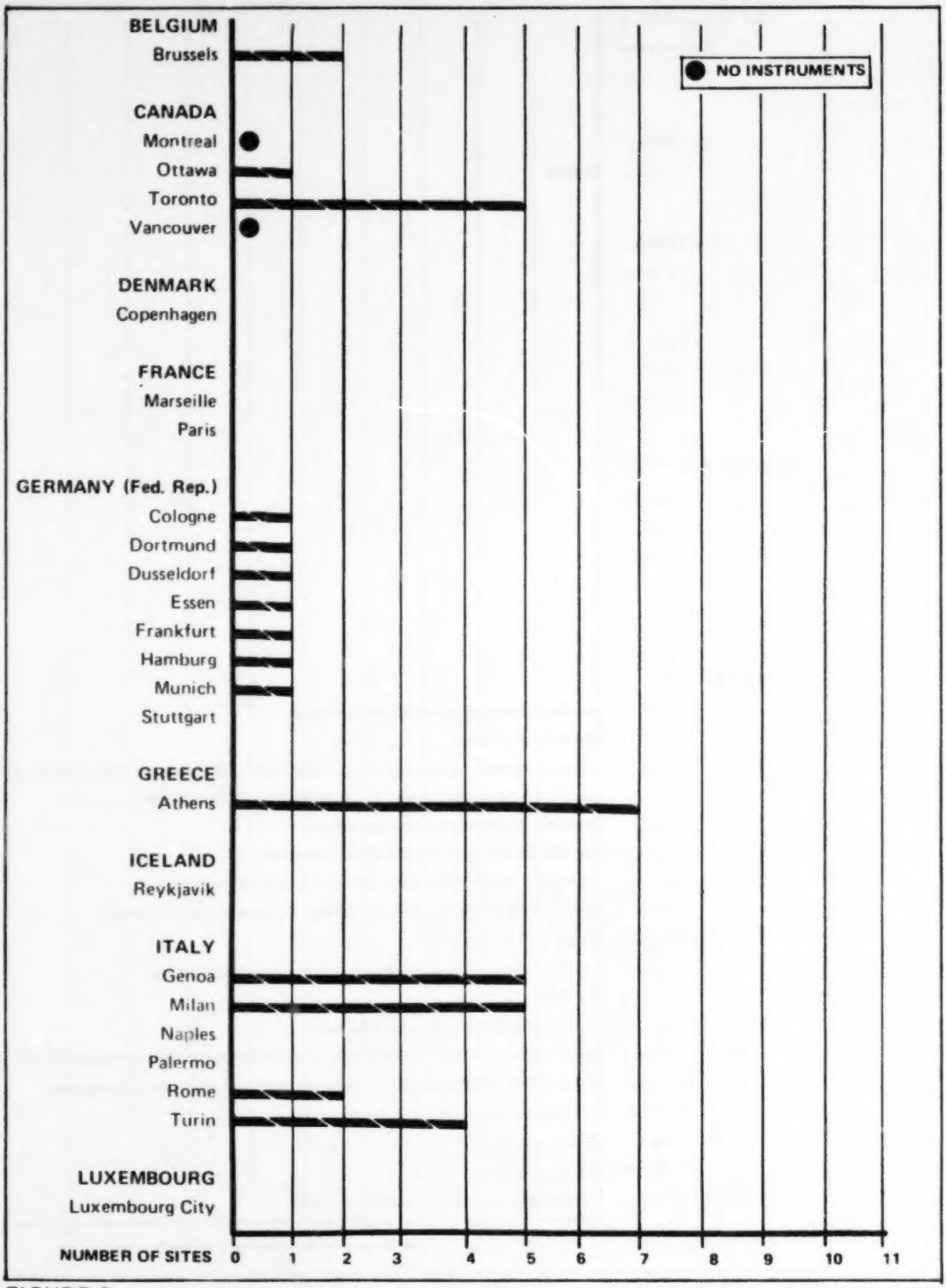


FIGURE 6
Sites with Wind Speed and Direction Instruments

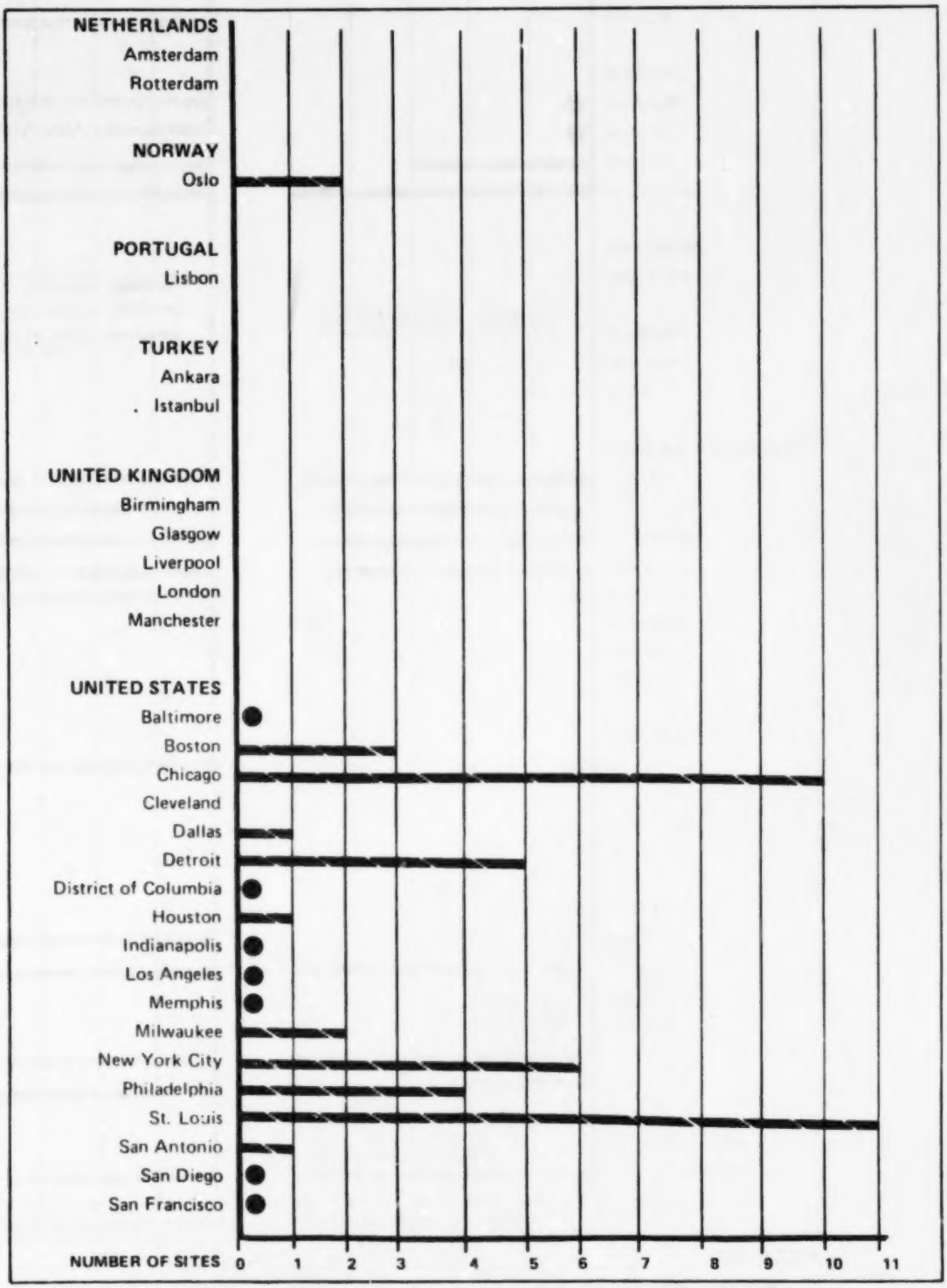


FIGURE 6 (continued)
Sites with Wind Speed and Direction Instruments

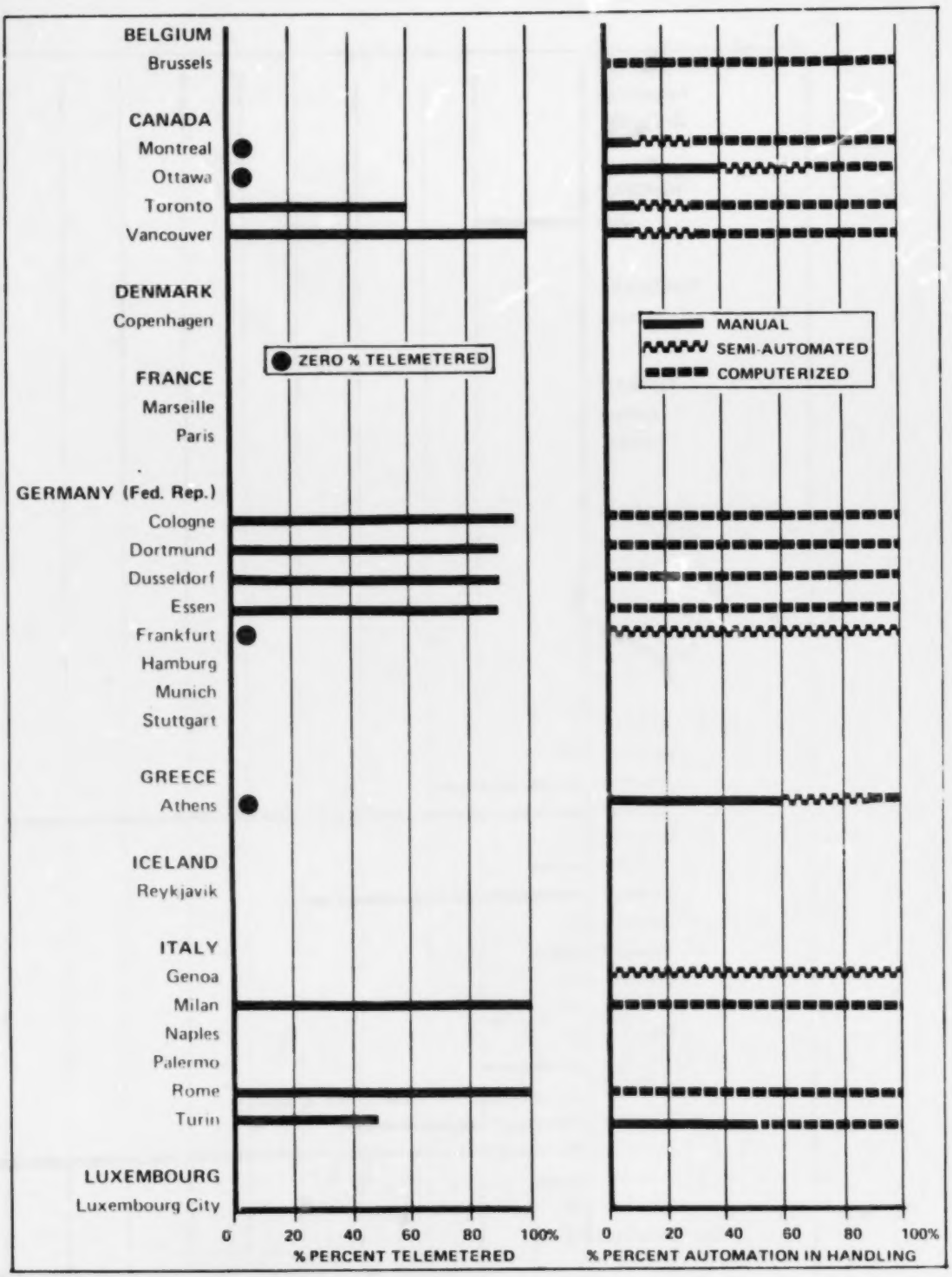


FIGURE 7
Monitoring Data Techniques

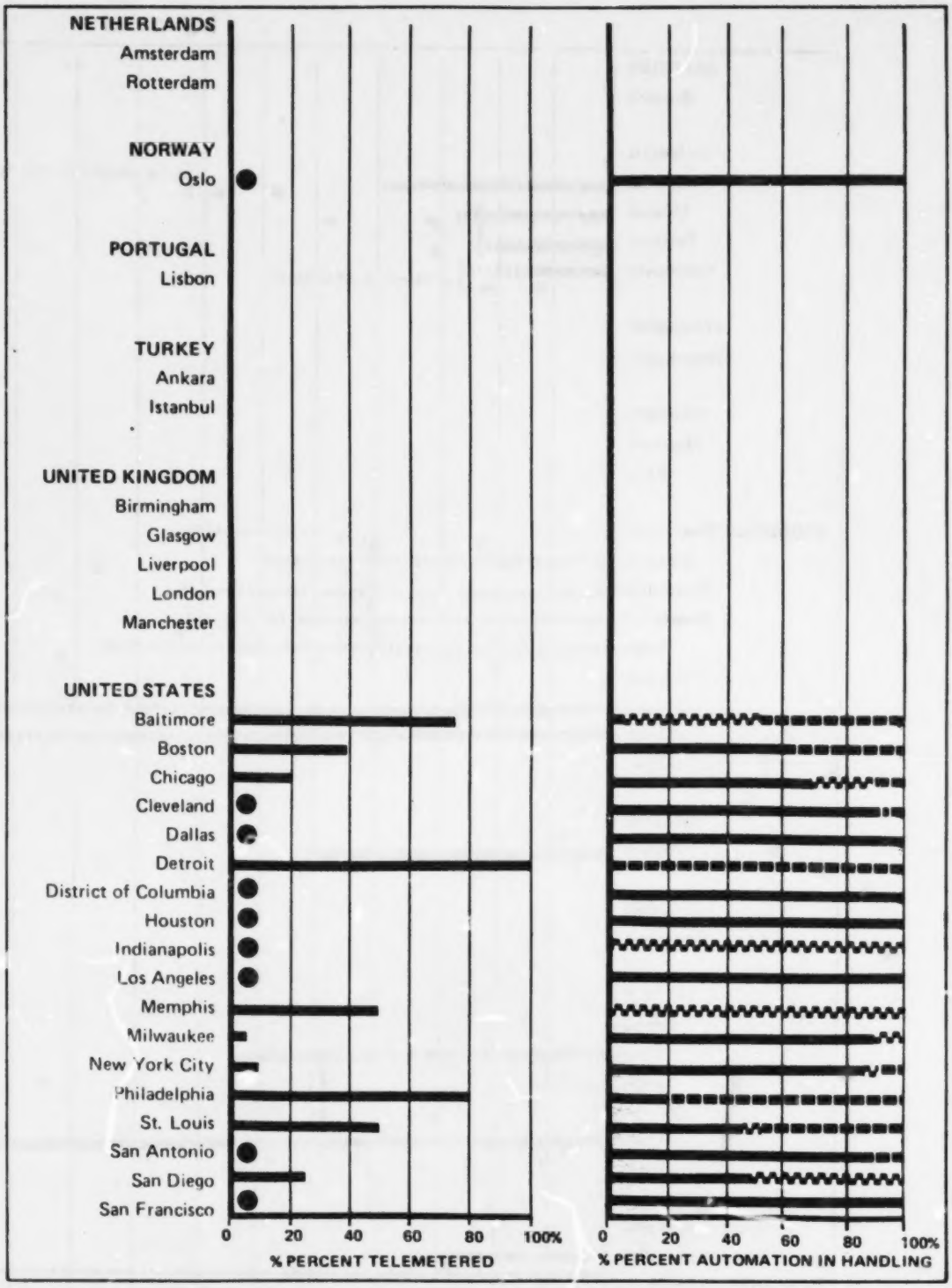


FIGURE 7 (continued)
Monitoring Data Techniques

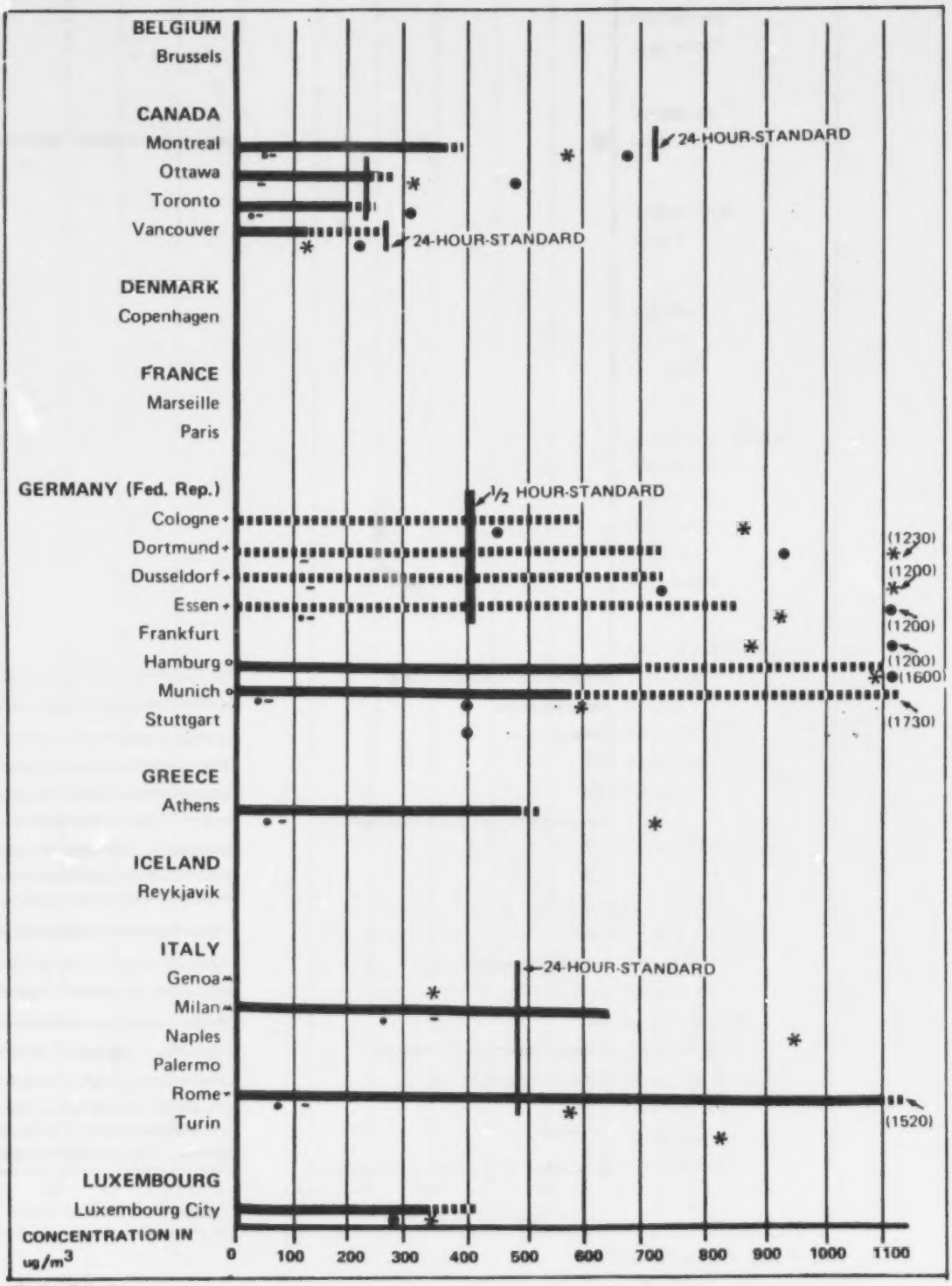


FIGURE 8
SO_2 Monitoring Data Compared to Standard

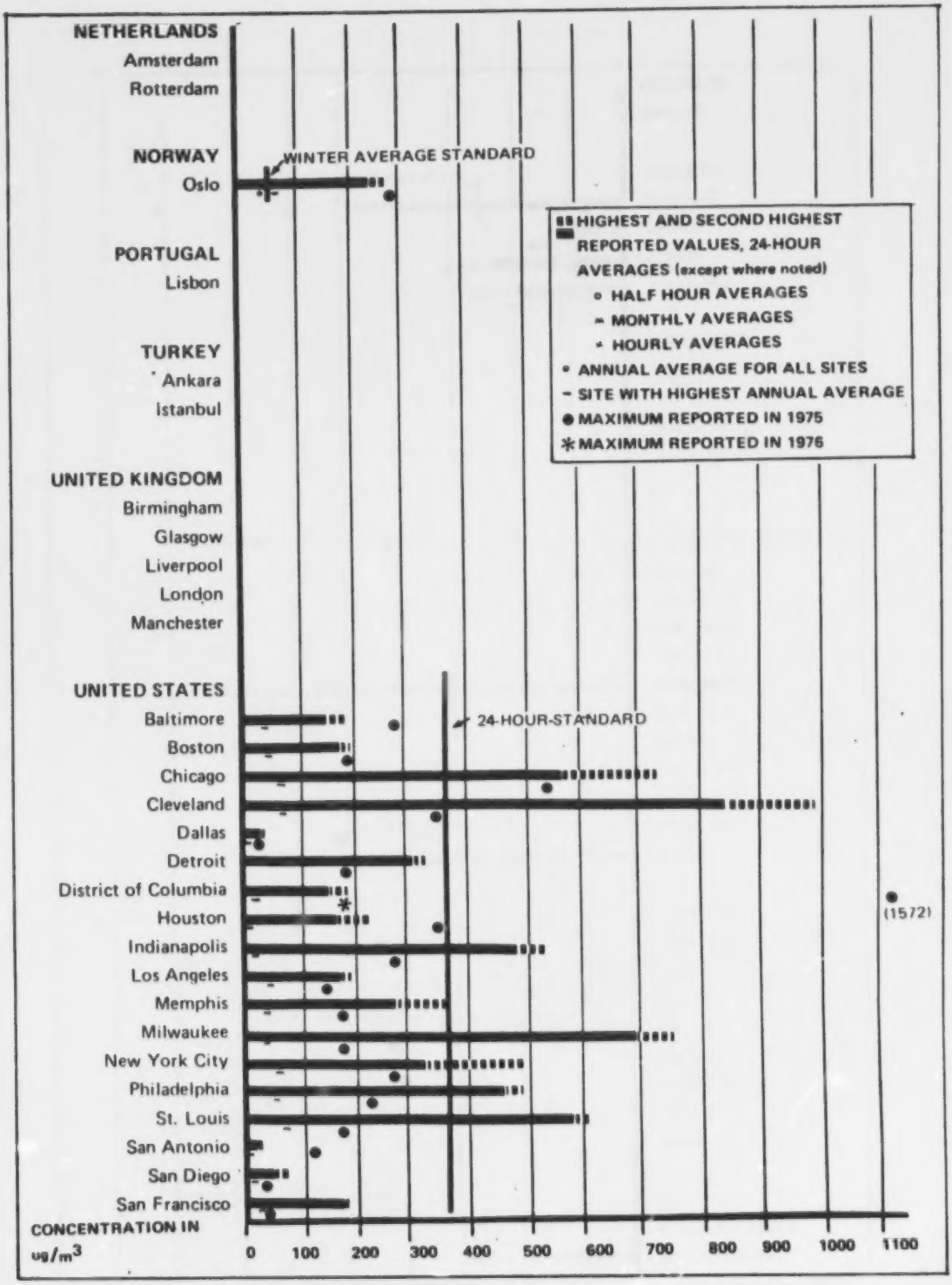


FIGURE 8 (continued)
SO_2 Monitoring Data Compared to Standard

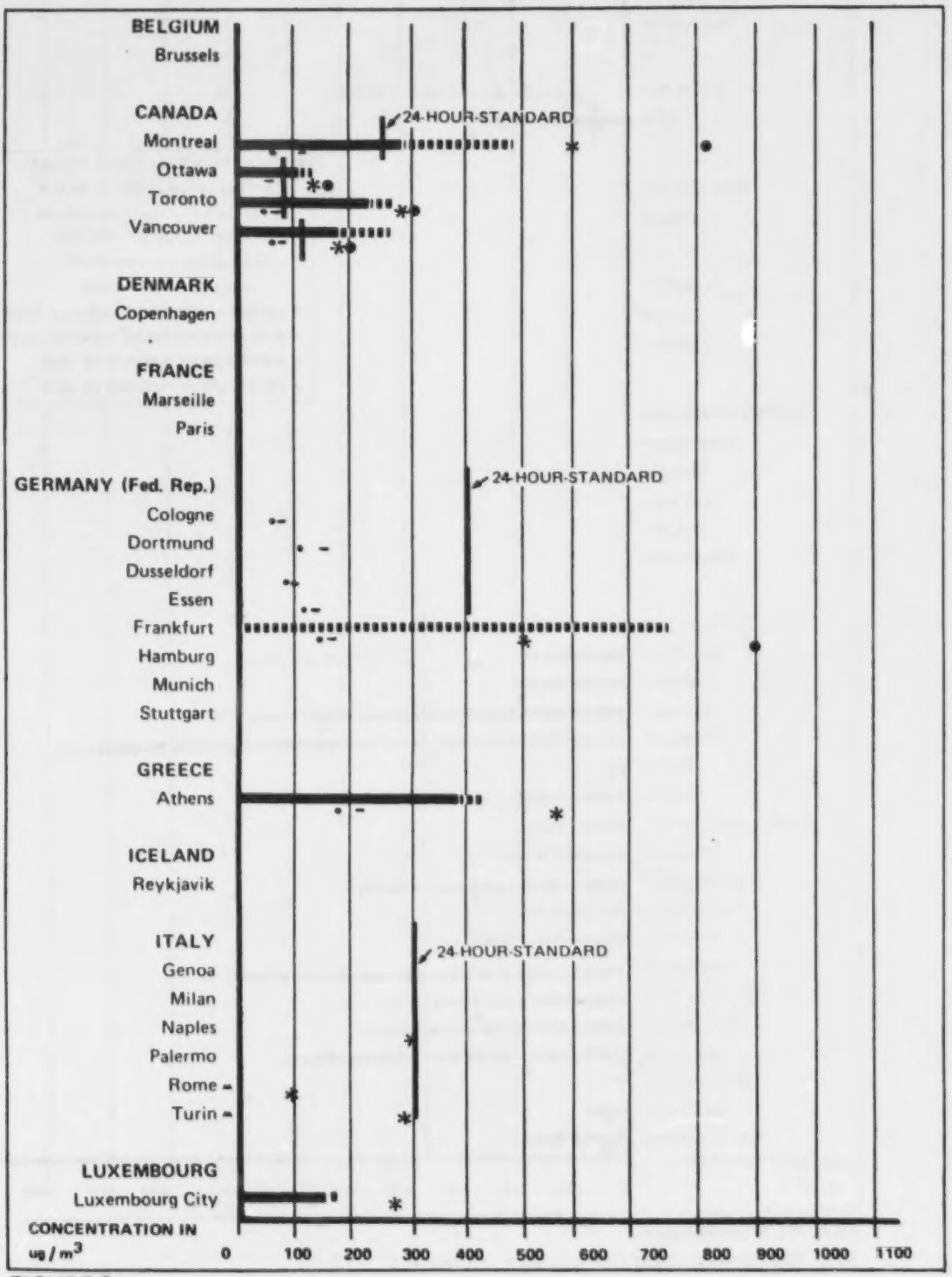


FIGURE 9
TSP Monitoring Data Compared to Standard

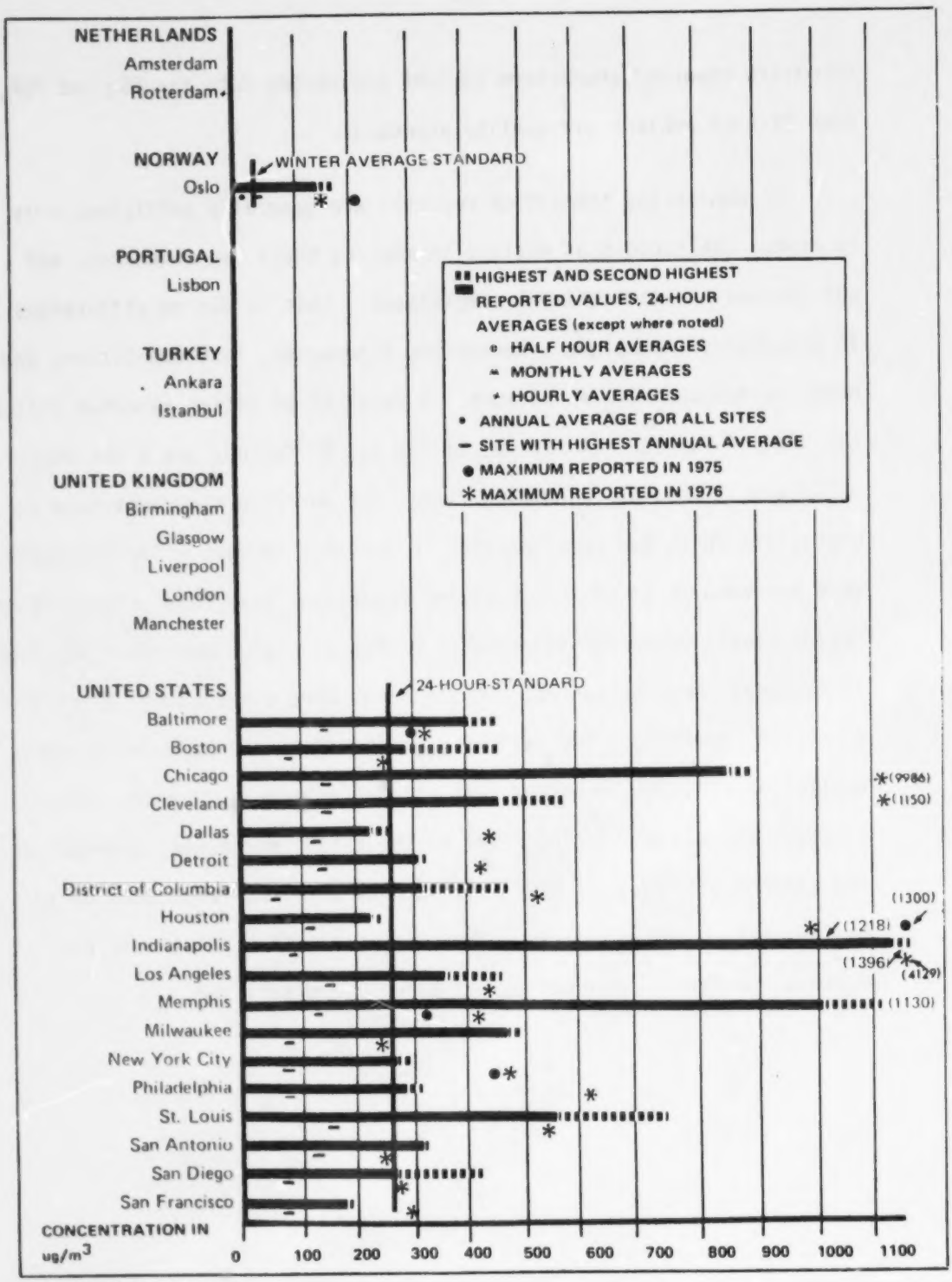


FIGURE 9 (continued)
TSP Monitoring Data Compared to Standard

summarize reported short-term ambient monitoring data for SO_2 and TSP, with 24-hour ambient air quality standards.

The monitoring statistics reported are generally sufficient only to assess the success of nations in meeting their own standards, and not for making international comparisons. This is due to differences in statistical techniques, monitoring strategies, instrumentation, and other variations between nations. A total of 34 cities reported statistics for SO_2, 26 for TSP, 24 for CO, 22 for O_x, 20 for NO_x and 2 for other pollutants. Several responding cities did not report current data for statistics which had been reported in previous surveys. TSP standards were exceeded in 21 of the 24 cities reporting; only three cities in one nation stayed below TSP standards. Of the 31 cities reporting SO_2 standards, 17 exceeded these standards. CO standards were exceeded for 17 of the 23 cities reporting. Two nations exceeded their standards with every monitoring statistic reported. In almost all cases, however, annual averages for all monitoring sites in the cities and annual averages for the maximum site in each city were far below the corresponding daily maximum values and standards. There is no distinct pattern in the maximum statistics reported in the three years surveyed.

ANALYSIS OF AMBIENT AIR QUALITY TRENDS

One point of Recommendation XIV indicates the need for international cooperation to accomplish review of ongoing air quality assessment studies. Figure 10 shows actual trends and the period of monitoring used in trend analysis. Figure 11 summarizes the available trends by pollutant.

A total of 63 analyses of ambient air quality trends were reported in this survey, distributed among five nations and 30 cities. Three reporting nations and seven reporting cities had no trend analysis. Ten cities reported a trend for only one pollutant. Two nations reported the same trend data as reported in previous surveys, while one nation had a number of additions and deletions from last year's report. One nation which had not reported analyses in previous surveys reported one analysis for SO_2, based on the winter mean. All other trends were based on annual averages of ambient concentrations, mostly using the statistical differences between time periods.

The trend analyses reported were predominantly for SO_2 (26) and TSP (22), but some analyses of trends for carbon monoxide (10), oxidants (3), nitrogen oxides (2), lead (4), soiling index (4), and fluorides (1), were reported. Almost all of the trends reported were for the period 1970-1975. A few of the trends reported were for periods of only two or three years. The average length of the monitoring period over which analysis had been performed was 6.1 years.

Thirty-three cases of improving air quality (constantly decreasing ambient concentration) and fifteen cases of stable air quality over the

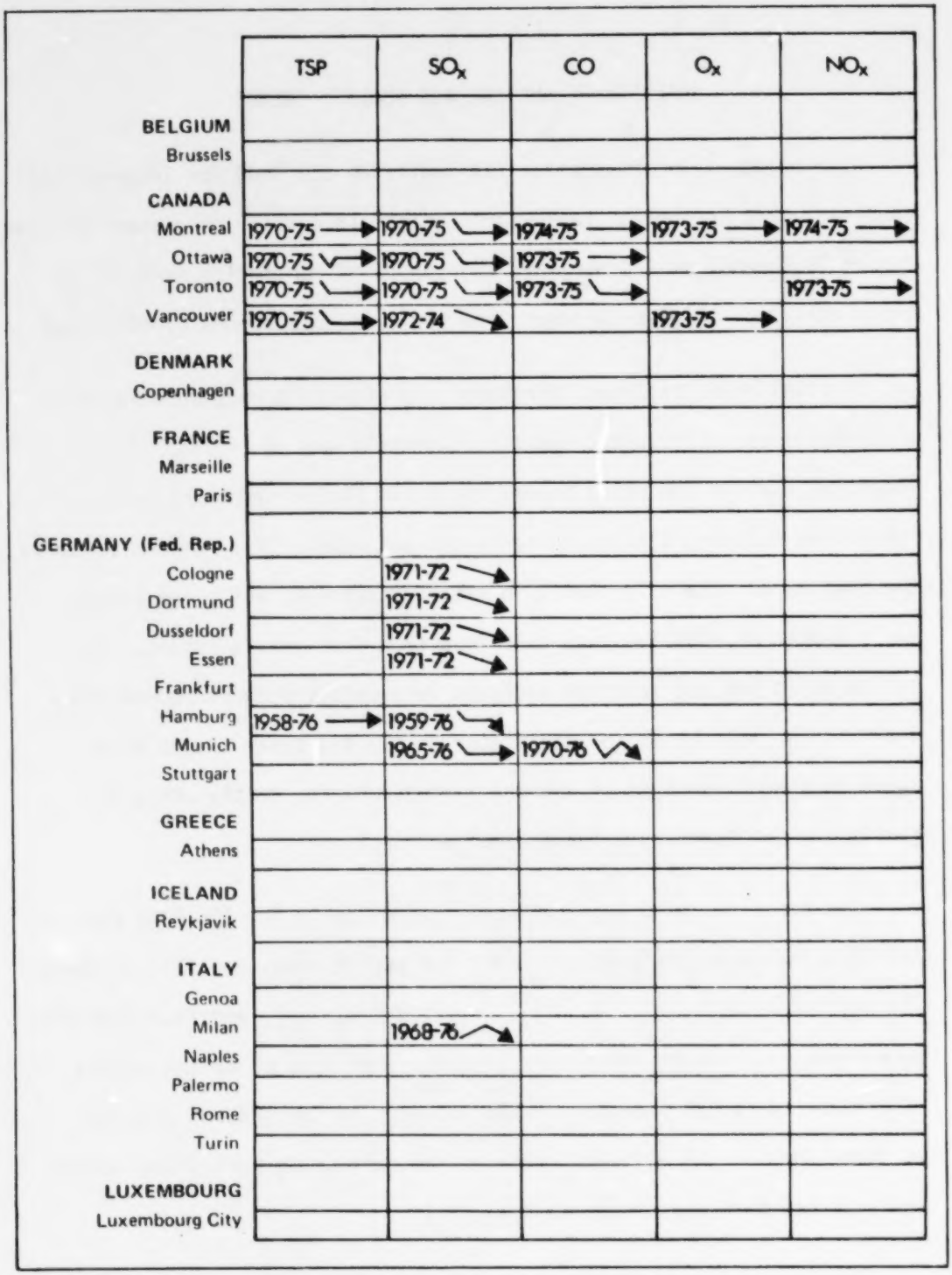


FIGURE 10
Ambient Air Quality Trend Analysis

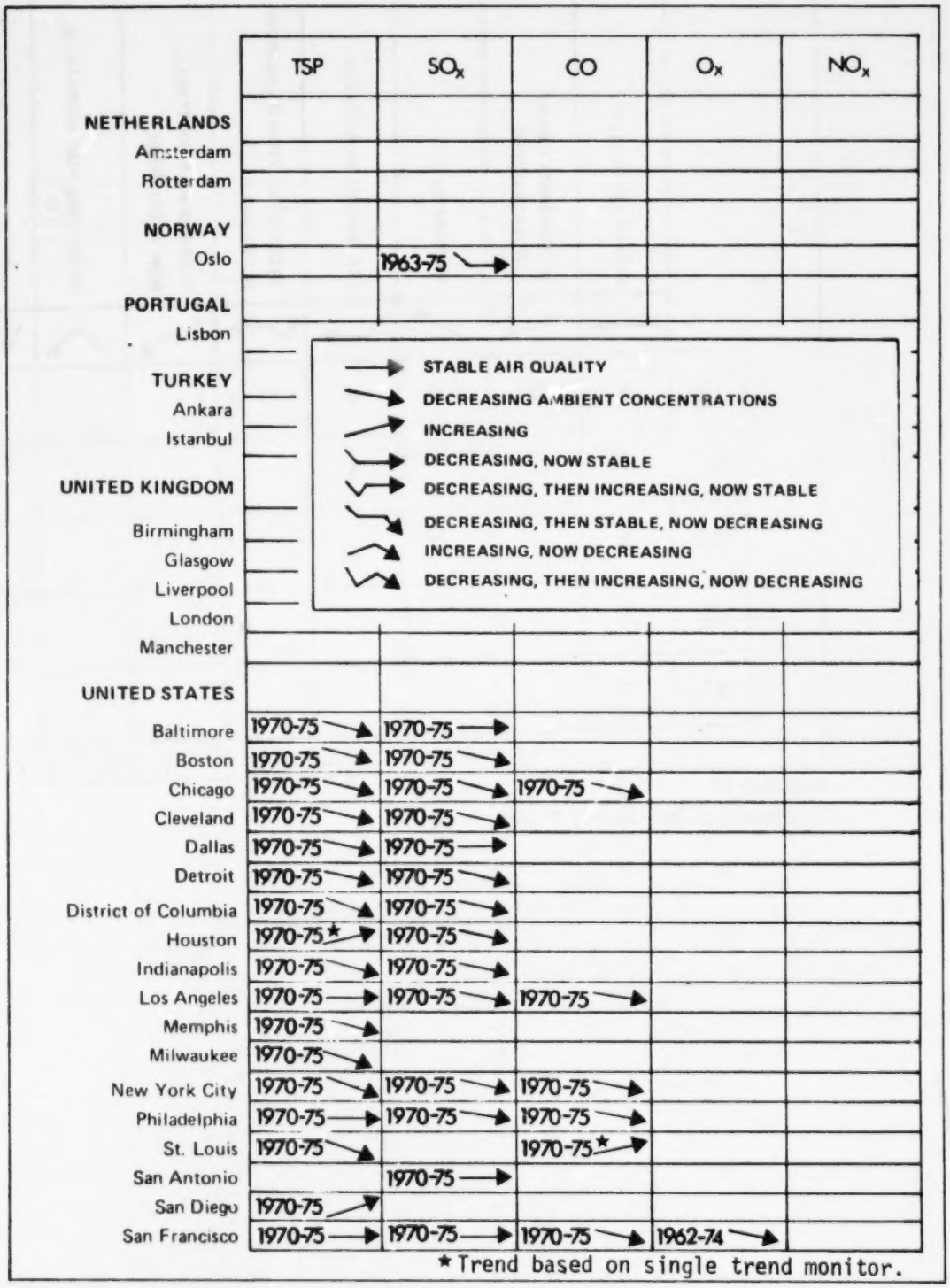
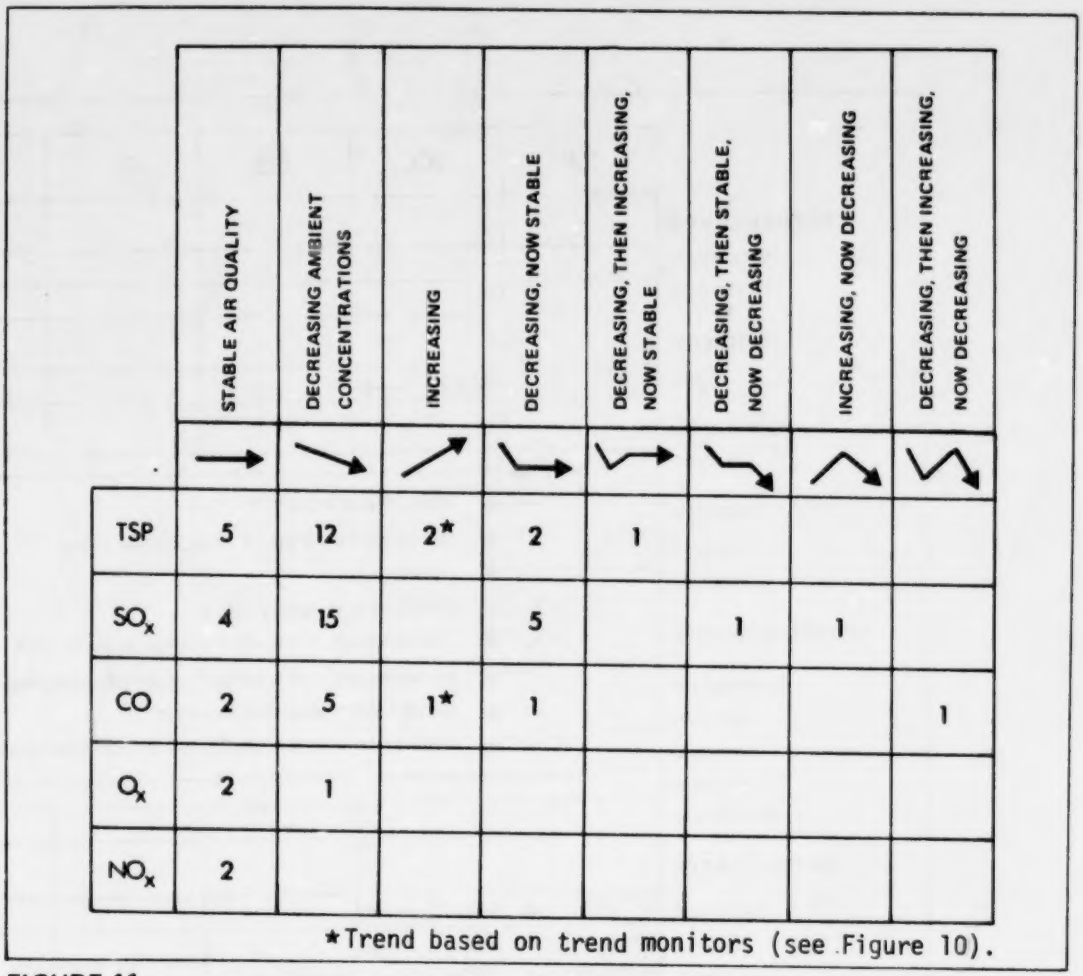


FIGURE 10 (continued)
Ambient Air Quality Trend Analysis



	STABLE AIR QUALITY	DECREASING AMBIENT CONCENTRATIONS	INCREASING	DECREASING, NOW STABLE	DECREASING, THEN INCREASING, NOW STABLE	DECREASING, THEN STABLE, NOW DECREASING	INCREASING, NOW DECREASING	DECREASING, THEN INCREASING, NOW DECREASING
TSP	5	12	2*	2	1			
SO_x	4	15		5		1	1	
CO	2	5	1*	1				1
O_x	2	1						
NO_x	2							

*Trend based on trend monitors (see Figure 10).

FIGURE 11
Summary of Air Quality Trends

entire analysis period were reported. There were three reported cases of air quality declining over the entire analysis period. A number of variable trends were also reported, as shown in Figure 11. Analyses show that SO_x trends were quite positive (17 currently decreasing, 20 currently stable). TSP trends were not quite as positive (12 decreasing, 8 stable, 2 increasing). This is a reversal from previous surveys, due to the newly-reported increasing TSP trends.

ATMOSPHERIC DISPERSION MODELING

Recommendations VII and XIV specify air quality modeling as part of prediction of future ambient concentrations. Figure 12 summarizes the modeling efforts reported in this survey. Twenty-six cities in six nations were reported to have been modeled. Eleven reporting cities had no models. A number of models reported in previous years were not mentioned in this year's responses. One nation added a substantial number of CO models to those reported in previous surveys.

The total of 58 individual models included 14 TSP models, 21 SO_X models, 17 CO models, 5 O_X and one NO_X model. Most models were Gaussian (45) rather than numerical (7) or empirical (5). Planning was listed as the major use for 44 models, 13 were also used for regulatory purposes and only 8 were used for research.

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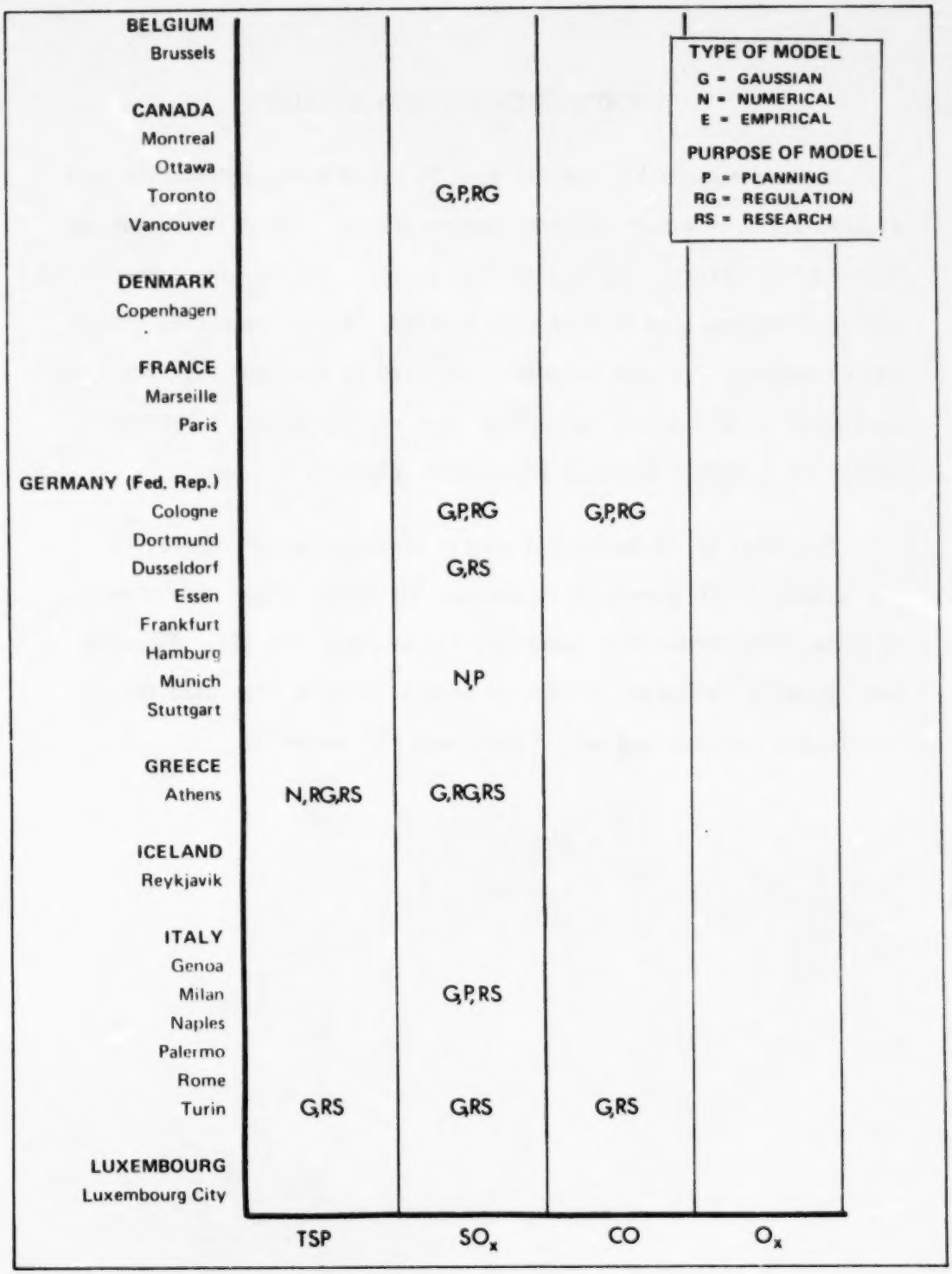

FIGURE 12
Atmospheric Dispersion Models

	TSP	SO_x	CO	O_x
NETHERLANDS				
Amsterdam				
Rotterdam				
NORWAY				
Oslo		N,RG		
PORTUGAL				
Lisbon				
TURKEY				
Ankara				
Istanbul				
UNITED KINGDOM				
Birmingham				
Glasgow				
Liverpool				
London				
Manchester				
UNITED STATES				
Baltimore	G,RG, RS	G,P	G,P	
Boston			G,P	
Chicago			G,P	
Cleveland	G,P	G,P,RG	G,P	
Dallas	G,P		G,P	
Detroit	G,P	G,P	G,P	
District of Columbia	G,P	G,P	G,P	E,P
Houston	G,P		G,P	
Indianapolis		G,RG	G,P	
Los Angeles		G,P,RG	N,P	N,P
Memphis	G,P	G,RG		
Milwaukee		G,P	G,P	
New York City	G,P,RG	G,P,RG		
Philadelphia	G,P	G,P		
St. Louis		G,P	G,P	
San Antonio	G,P		G,P	
San Diego	E,P	G,P	G	N,P
San Francisco	E,P	G,P	E	N,E,P

FIGURE 12 (continued)
Atmospheric Dispersion Models

ACTIVITIES OF NATIONAL, REGIONAL, AND LOCAL AUTHORITIES

Figure 13 provides an overview of the division of responsibility and activity in air pollution control in North Atlantic Council countries. It is based on the responses to various questions related to standards, monitoring, modeling, and auto surveillance for emission factor development. Figure 13 indicates that there is considerable variety in the division of responsibility between national, regional and local authorities. Three nations rely on national standard-setting and administration and support by some combination of national, regional, local and other organizations. One nation groups most activity at the regional level, with general national support and local standard-setting and administration in one region. Another relies on local authorities in its largest city and some support from national institutes. Responses in this area are generally the same as in previous years, with a few added modeling and monitoring efforts.

	STANDARD-SETTING	MONITORING	MODELING	AUTO SURVEILLANCE
BELGIUM		N		
CANADA	R,L	N,R,L	N,R	N
DENMARK				
FRANCE				
GERMANY (Fed. Rep.)	N	R,L	R,L,O	
GREECE		N	N	O
ICELAND				
ITALY	N	R,L,O	N	
LUXEMBOURG				
NETHERLANDS				
NORWAY	L	L,O	O	O
PORTUGAL				
TURKEY				
UNITED KINGDOM				
UNITED STATES	N	N,R,L	N,R,L	N

N– NATIONAL/FEDERAL
R– REGIONAL/STATE/PROVINCIAL
L– LOCAL/MUNICIPAL
O– OTHER (PRIVATE ORGANIZATIONS, INSTITUTES)

FIGURE 13
Activities of National, Regional, and Local Authorities, 1977

DATA AVAILABILITY

Recommendation IV of the Air Pollution Pilot Study encourages establishment of systems for monitoring data storage and retrieval as essential to successful control efforts. Figure 14 summarizes the availability of various data elements by nation. Data were considered "available" if they were reported for one or more cities in a nation, in this year's survey.

Some nations had relatively uniform sets of data for all cities, while some nations had considerable internal variety in pollutants measured and time periods. Most cities reported availability of ambient air quality data for SO_2 and TSP (or other equivalent/related pollutants such as soot, dust, or smoke). Monitoring of CO was also fairly common. A total of seven nations had data available on at least one pollutant, four of which had data on three or more. One nation failed to report ambient statistics on two parameters reported in previous surveys. Three reporting nations added one or more pollutants over previous survey responses.

Data on emissions was slightly less common, but more uniform within nations, than ambient air quality data. Only five nations reported having emissions data available. One nation failed to confirm previously reported availability of emissions data. Three of these nations also have sets of emission factors available for possible synthesis of emission inventories.

	POINT SOURCES	STATIONARY AREA SOURCES	MOBILE AREA SOURCES	LINE SOURCES	EMISSION FACTORS	AMBIENT AIR QUALITY
BELGIUM						
CANADA			CO,HC, NO_x			TSP,SO_2,CO, O_x,NO_x
DENMARK						
FRANCE						
GERMANY (Fed. Rep.)						TSP,SO_2,CO
GREECE	TSP,SO_2	ALL	ALL	ALL	●	TSP,SO_2
ICELAND						
ITALY	TSP	SO_2				SO_2
LUXEMBOURG						TSP,SO_2
NETHERLANDS						
NORWAY	SO_2	ALL	ALL		●	TSP,SO_2,CO
PORTUGAL						
TURKEY						
UNITED KINGDOM						
UNITED STATES	ALL	ALL	ALL		●	TSP,SO_2, CO, O_x, NO_x

ALL = TSP,SO_2,CO,HC,NO_x

FIGURE 14
Data Availability

APPENDIX:

AIR POLLUTION PILOT STUDY

RECOMMENDATIONS

Committee on the Challenges of Modern Society

(1974)

Air Pollution Pilot Study
Recommendations

Fifteen recommendations were derived from the results of the Pilot Study. Adoption of these recommendations will demonstrate that member nations have dedicated themselves to acting on the results of this pilot effort and will move toward a dynamic and systematic solution of our common air pollution problems.

Seven recommendations are made for assessment of air quality: the first general, the second three for monitoring, and the remaining three for emissions inventory:

RECOMMENDATION I

Member nations will assess the air pollution in cities of 100,000 inhabitants or more and in industrial areas within their national boundaries. Member nations should establish such assessments by 1980.

RECOMMENDATION II

Member nations will establish effective air quality monitoring systems including the measurement of meteorological parameters.

RECOMMENDATION III

Member nations will employ reference methods endorsed by the World Health Organization (WHO), the Organization for Economic Cooperation and Development (OECD), and/or the International Standards Organization, or alternative

methods which have been shown to be comparable to these reference methods.

RECOMMENDATION IV

Member nations will establish systems for monitoring data storage and retrieval such as those employed by the WHO.

RECOMMENDATION V

Member nations will conduct emissions inventories employing the uniform procedures based on the experience derived from the CCMS assessment studies.

RECOMMENDATION VI

Member nations will cooperate to develop standardized methods for emissions data storage and retrieval to support requirements in the conduct of national air quality management programs. The U.S. National Emission Data System (NEDS) might serve as a model for a common international system.

RECOMMENDATION VII

Member nations will cooperate to develop standardized techniques for projecting emissions and predicting future ambient air quality.

The recommendations regarding air quality criteria are:

RECOMMENDATION VIII

Member nations, in accordance with national priorities, will set ambient air quality standards or objectives.

The criteria documents developed in CCMS and the guides and criteria developed by WHO should be used in this process.

RECOMMENDATION IX

Member nations will participate in the WHO program for development of criteria documents as well as in the revision of existing criteria documents.

RECOMMENDATION X

Member nations will support strongly national research programs and cooperate internationally for the purpose of developing additional criteria on the environmental effects of all air pollutants.

The recommendations regarding control technology are:

RECOMMENDATION XI

Member nations will use inter alia CCMS control technology documents in developing plans for applying control to existing pollution sources to improve air quality.

RECOMMENDATION XII

Member nations will, in the course of industrial expansion, employ the best available and practicable control technology on an industry-by-industry basis.

RECOMMENDATION XIII

Member nations will assure the exchange of new information on research, development, and demonstration of the control

technology. CCMS derived control technology documents should be updated periodically to reflect significant advances. The appropriate international body for this effort is the WHO International Reference Center for Air Pollution Control.

The recommendation resulting from the modeling activity is:

RECOMMENDATION XIV

Member nations agree that the CCMS modeling activity has shown that there is a widespread need for further international cooperation to accomplish the following tasks:

- To continue to bring together model developers and air quality managers for exchange of ideas, discussion of users' needs, and demonstration of modeling techniques.
- Standardize modeling techniques for specific air quality management applications and consider how computerized models might be made available for all users.
- Continue to review on-going air quality assessment studies.

The recommendation for LPPSD is:

RECOMMENDATION XV

Participating nations agree to take necessary actions to implement fully the memorandum of understanding, with

emphasis on collaboration on the total systems approach for developing environmentally compatible motor vehicles taking into account air quality, safety, energy, and noise.